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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the capacitor accumulating electricity device constituted by connecting two or more capacitors in series, and is especially that charging system and the thing concerning the degradation detection system of that capacitor further.
[0002]
[Description of the Prior Art]These days, the electric double layer capacitor attracts attention as a large capacity capacitor excellent in the charging and discharging characteristic. However, for using it as a capacitor accumulating electricity device of a practical voltage rating, more than one need to connect with series, and it is necessary for the voltage of a single machine of this electric double layer capacitor to be low, and to constitute. Drawing 14 is a circuitry figure showing briefly the capacitor accumulating electricity device which connects two capacitors in series. In a figure, if the switch S1 is closed, fixed current will flow into a series connection body with the capacitors C1 and C2 from a constant current source, and both the capacitors C1 and C2 will be charged. After charge is completed, the switch S1 is opened, and if the switch S2 is closed, current will be discharged from the capacitor C1 and C2 by the discharging resistance which is load.
[0003]Drawing 15 shows the capacitor C1 in this case, and the charging and discharging characteristic of C2. If the capacitors C1 and C2 are charged according to constant current in time t1, the voltage of each capacitors C1 and C2 will rise according to the patterns P1 and P2, and will turn into the voltage E1 and E2 in time t2. The voltage E1 and E2 differs in time t2 because electric capacity with the capacitors C1 and C2 has a difference. If it discharges from the time t2, both the capacitors C1 and the voltage of C2 will return to the original zero in time t3.
[0004]When the capacitor connected in series is charged by constant current, the capacitor C1

reaches the rated voltage E1 previously, and make charge relatively ended in time t2 in the example of a capacitor with small electric capacity, and drawing 15, but. The charge voltages at this whole time are set to E1+E2, from voltage 2 and E1 when both capacitors of both are charged to the rated voltage E1, only E1-E2 (=2 and E1- (E1+E2)) becomes low, and the capacity factor as an accumulating electricity device becomes low. If it can charge simultaneously to the voltage E1 with the same charge of the capacitor C2, as shown in drawing 16, the capacity factor will become high.

[0005]Drawing 17 is a circuitry figure showing the conventional capacitor accumulating electricity device which can charge simultaneously the capacitors C1 and C2 with an electric capacity deviation to rated voltage by using the resistance R as partial pressure resistance. In a figure, when the switch S1 is closed, the capacitor accumulating electricity device was charged with the current value I from the constant current source and the capacitor C1 and voltage of C2 are set to V1 and V2, the following expression of relations is realized in the current I1 and I2 which flow into the partial pressure resistance R.

V1-V2=deltaV I2=V2/R I1=V1/R=(V2+deltaV)/R=V2/R+delta V/R=I2+deltaV/R[0006]Here, if V1-V2=deltaV>0, the diversion of river I1 to the partial pressure resistance R connected to the capacitor C1 will increase by deltaV/R from the diversion of river I2 to the partial pressure resistance R connected to the capacitor C2. Since fixed current is supplied from a constant current source, as a result, the charging current to the capacitor C1 decreases from that of the capacitor C2, and the partial pressure resistance R serves to equalize both the capacitors C1 and the voltage of C2.

[0007]

[Problem(s) to be Solved by the Invention]The conventional capacitor accumulating electricity device is constituted as mentioned above, and if it is not coped with at all, the capacity factor as an accumulating electricity device becomes low for the deviation of the electric capacity of the capacitor connected in series. In the thing of the method which equalizes the charge voltages of each capacitor using partial pressure resistance, since the diversion of river of the current was always carried out to the partial pressure resistance, there was a problem that power loss became large. While having repeated charge and discharge, even if one capacitor deteriorated and the capacitance omission arose, since it was connected to series by more than one, the capacitor was difficult to distinguish the capacitor which deteriorated.

[0008]While this invention was made in order to cancel the above problems, and its power loss at the time of charge is small and being able to charge effectively each capacitor which constitutes a device to rated voltage, It aims at obtaining the capacitor accumulating electricity device which can detect the capacitor which deteriorated certainly.

[0009]

[Means for Solving the Problem]In a capacitor accumulating electricity device which a

capacitor accumulating electricity device concerning this invention connects two or more capacitors in series, connects a constant current source to this series connection body, and charges the above-mentioned capacitor, The 1st voltage detection means that will output a detecting signal if it is provided for every above-mentioned capacitor, voltage between that terminal is detected and this detection voltage reaches the 1st predetermined specified voltage, A series connection body of a regulation capacitor and a switching means which were connected between terminals for every above-mentioned capacitor, And it has the 2nd voltage detection means that will output a detecting signal if it is provided for every above-mentioned capacitor, voltage between that terminal is detected and this detection voltage reaches the 2nd predetermined specified voltage, If a detecting signal is outputted from the 1st voltage detection means of the above, when the 1st voltage detection means concerned will carry out the closed circuit of the connected switching means at the time of charging operation, If a detecting signal is outputted from the 2nd voltage detection means of the above, it is made to judge with a capacitor to which the 2nd voltage detection means concerned was connected carrying out capacity deterioration, while enabling equalization of the amount of the maximum charging charge of each capacitor group by which the series connection was carried out [above-mentioned].

[0010]A capacitor accumulating electricity device concerning this invention makes the same value those 1st and 2nd specified voltage, and makes output responses of a detecting signal of the 2nd voltage detection means later than output responses of a detecting signal of the 1st voltage detection means.

[0011]A capacitor accumulating electricity device concerning this invention shall detect voltage between terminals of that capacitor via a voltage divider, and the 1st and 2nd voltage detection means share the above-mentioned voltage divider.

[0012]A capacitor accumulating electricity device concerning this invention is provided with a capacitor degradation displaying means which displays a capacitor judged with a detecting signal from that 2nd voltage detection means to be capacity deterioration as other capacitors identifiable.

[0013]A capacitor accumulating electricity device concerning this invention is provided with a charge circuit opening means which separates a constant current source and a capacitor group when a detecting signal is outputted from all that 1st voltage detection means.

[0014]A capacitor accumulating electricity device concerning this invention is provided with a charge circuit opening means which separates a constant current source and a capacitor group with a detecting signal from that 2nd voltage detection means.

[0015]A capacitor accumulating electricity device concerning this invention will be provided with a charge circuit opening means which separates a constant current source and a capacitor group, if voltage of a series connection body of that capacitor is detected and this

detection voltage exceeds predetermined upper limit.

[0016]

[Embodiment of the Invention]Embodiment 1. drawing 1 is a circuitry figure showing the capacitor accumulating electricity device in this embodiment of the invention 1. In a figure, 1 is a constant current source and is taken as a concept also including the voltage source provided with a means to restrict charging current to constant value here. The discharging resistance whose 2 is load, the capacitor which 3 and 4 made in-series mutually a switch (S1, S2), and 5 and 6, and was connected to the constant current source 1 (each nominal capacity is Ca), 7 and 8 are the voltage detection circuits connected between the terminals of the capacitors 5 and 6, respectively, and if it becomes below rated voltage about an ON signal again, they will output an OFF signal to the switching means which will be later mentioned if the voltage of the connected capacitor exceeds predetermined specified voltage (rated voltage).

[0017]9 and 10 are the regulation capacitors (each nominal capacity is Cb) which became in-series with the electronic switches 11 and 12 as a switching means, respectively, and were connected between the terminals of each capacitors 5 and 6, The electronic switches 11 and 12 can use self arc extinguishing type switching elements, such as GTO and IGBT. 13 and 14 are the diodes connected to the electronic switches 11 and 12 at contrary parallel, respectively.

[0018]Next, operation of charge and discharge is explained with reference to drawing 2. Drawing 2 (a) shows the voltage characteristic pattern of the capacitors 5 and 6, and the figure (b) shows the voltage characteristic pattern of the regulation capacitors 9 and 10. If the switch 3 (S1) is closed in time t1 and fixed charging current is supplied to the series connection body of the capacitors 5 and 6 from the constant current source 1, The voltage V1 of both the capacitors 5 and 6 and V2 go up, as shown in drawing 2 (a), and in actual electric capacity, since the capacitor 5 is smaller than the capacitor 6, the voltage V1 reaches the rated voltage E1 of a capacitor previously in time t2 here.

[0019]One [the voltage detection circuits 7 detect this, and an ON signal is sent out, and / the electronic switch 11] if the voltage V1 of the capacitor 5 tends to exceed the rated voltage E1 from the time t2. The charging current from the constant current source 1 shunts toward the regulation capacitor 9 by this, and voltage V_1 of the regulation capacitor 9 goes up (drawing 2 (b)). Here, if the voltage V1 of the capacitor 5 turns into below rated voltage, the voltage detection circuits 7 send out an OFF signal, and the electronic switch 11 turns them off again. By repeating the above, the voltage V1 of the capacitor 5 is maintained at rated voltage regularity, and voltage V_1 of the regulation capacitor 9 continues a rise.

[0020]If the voltage V2 of the capacitor 6 similarly reaches the rated voltage E1 in time t3, the switch 3 (S1) will be opened wide and will end charge. Voltage V_1 of the regulation capacitor 9

is charged to the voltage E5. If the switch 4 (S2) closes in time t3 and the discharging resistance 2 is connected, a capacitor accumulating electricity device will start discharge and the voltage V1 of the capacitors 5 and 6 and V2 will descend. If the voltage V1 of the capacitor 5 descends to voltage V_1=E5 of the regulation capacitor 9 (time t4), the voltage of the capacitor 5 and the regulation capacitor 9 will become the same, and the diode 13 flows, and both the capacitors 5 and 9 will become parallel and will discharge. Therefore, inclination of the descent pattern of the voltage after the time t4 becomes looser than inclination of the voltage drop pattern of the capacitor 5 till then. If discharge is continued in this state, all the electric charges of the capacitors 5 and 6 and the regulation capacitor 9 will be discharged in time t8, and voltage will serve as zero. The dashed dotted line part of drawing 2 shows this.

[0021]If it returns, and the switch 4 is considered as open and charge is resumed by making the switch 3 close in time t5, the voltage V1 of the capacitors 5 and 6 and V2 will go up, and the voltage V1 of the capacitor 5 will reach the rated voltage E1 in time t6. Since the diode 13 is wide opened in time t5, the regulation capacitor 9 is maintaining the charge voltages E6 at that time after that. If the voltage V1 of the capacitor 5 tends to exceed the rated voltage E1 in time t6, The voltage detection circuits 7 send out an ON signal again, henceforth, the electronic switch 11 repeats one and OFF, the diversion of river to the regulation capacitor 9 is made like the time t2 back, the voltage V1 of the capacitor 5 is maintained at the rated voltage E1, and voltage V_1 of the regulation capacitor 9 goes up. Both the voltage V1 of both the capacitors 5 and 6 and V2 become the rated voltage E1 in time t7, and charging operation is ended.

[0022]Namely, even if electric capacity differs mutually in the capacitor connected in series according to this invention, By connecting in parallel the regulation capacitor for amendment which has the electric capacity more than this difference via an electronic switch, each capacitor is charged to rated voltage and equalization of the amount of the maximum charging charge of each capacitor group which becomes with a capacitor and a regulation capacitor is attained. At the time of discharge, even the charging charge of a regulation capacitor can be used effectively. Like before, since partial pressure resistance is not used, power loss does not occur for the above-mentioned equalization.

[0023]Next, the electric capacity which is needed as a regulation capacitor is explained. When capacity variation [as opposed to Ca and this nominal capacity for the nominal capacity of each capacitor] is made into **pa%, as a regulation capacitor, The capacity equivalent to the difference of the maximum capacity of a capacitor, and minimum capacity, i.e., Ca-(+pa- (-pa)) /100=2$_{\text{and}}$Ca-pa/100, ... (1) is needed. By the way, when two or more regulation capacitors also exist, variation exists to the nominal capacity.

[0024]Therefore, if capacity variation [as opposed to Cb and this nominal capacity for the required nominal capacity of a regulation capacitor] is made into **pb%, Since the minimum

capacity of a regulation capacitor, i.e., Cb-(100-pb) /100, needs to be beyond the capacity value of the above-mentioned (1) formula, it is Cb-(100-pb) /100>=2andCa-pa/100... It is set to (2) and the required nominal capacity Cb of a regulation capacitor is obtained by (3) formulas after all.

Cb>=2andCa-pa/(100-pb) ... (3)[0025]Although the usual capacity variations, such as an electric double layer capacitor, are about 15%, By being what carried out multiple connection of two or more capacitor simple substances, respectively, and constituting the capacitor of each stage connected in series, as capacity variation of the capacitor of each stage, it becomes smaller than the above-mentioned numerical value probable, and the required capacity of a regulation capacitor can be reduced.

[0026]That is [in the case of the method using the conventional partial pressure resistance, in addition to the problem of generating of the power loss mentioned already, it can seldom enlarge calorific value of the resistance single machine], single machine capacity of resistance can seldom be enlarged. Therefore, even when connecting per 1 in-series stage and two or more capacitors in parallel, it is necessary to connect partial pressure resistance to each capacitor each, structure cannot but become complicated as a whole, and reliability also cannot but fall from increase of part mark. On the other hand, since it is not accompanied by resistance heating in the case of the invention in this application using a regulation capacitor, there are no restrictions in particular in increase of the single machine capacity of a regulation capacitor or a switching means. Therefore, when two or more capacitors are connected in parallel per 1 in-series stage as above-mentioned, The composition which establishes 1 set of regulation capacitors and a switching means to the capacitor of the synthetic capacity which carried out multiple connection is employable, and while the structure as the whole becomes easy, there is an advantage of also reducing cost.

[0027]Embodiment 2. drawing 3 is a circuitry figure showing the capacitor accumulating electricity device in this embodiment of the invention 2. In this drawing 3, the constant current source 1, the discharging resistance 2, and the switches 3 and 4 are omitting the graphic display. Only one step of the capacitor 5 grade by which a series connection is carried out is illustrated. In the figure, 15 and 16 are the relays driven with voltage detection circuits and the output from these voltage detection circuits 15, and the point of contact of the relay 16 is made in-series with the regulation capacitor 9, and is connected between the terminals of the capacitor 5.

[0028]Next, operation of charge and discharge is explained with reference to drawing 4. If charge is started in time t1, the voltage of the capacitors 5 and 6 will rise according to the pattern P1 and P2, and the voltage of the capacitor 5 will reach the rated voltage E1 in time t2. The voltage detection circuits 15 detect this, drive the relay 16, carry out the closed circuit of the point of contact, and make charging current shunt toward the regulation capacitor 9. Since

the electric charge accumulated in the capacitor 5 will be distributed to the capacitor 5 and the regulation capacitor 9 and it will store electricity it if there are no resistor and ****** which restrict current to a circuit at this time, the voltage of the capacitor 5 descends to the voltage E3 in an instant. Since the electric capacity Cb of the regulation capacitor 9 and electric capacity Ca of the capacitor 5 are set as the relation mentioned above, this voltage E3 in the time t2 that descended serves as a value lower than the voltage E2 of the capacitor 6 in the time.

[0029]The voltage detection circuits 15 so that the signal which opens the point of contact of the relay 16 may not be outputted unless it becomes less than lower-limit-voltage E4 [still lower than the voltage E3 immediately after this closed circuit] predetermined if the rated voltage E1 is once detected and the point of contact of the relay 16 is closed-operated, The operating characteristic which does not establish and carry out hunching of the hysteresis is given. Therefore, after the time t2, the capacitor 5 and the regulation capacitor 9 are connected in parallel, and charging operation advances. And the voltage of the capacitor 6 reaches the rated voltage E1 in time t3, and charge is ended.

[0030]By the way, supposing the level E3 with which the regulation capacitor 9 was thrown in in time t2, and the voltage of the capacitor 5 descended in the charging and discharging characteristic of drawing 4 becomes higher than the level E2 of the capacitor 6 between simultaneous, This means that a capacitor deteriorates and the capacity is insufficient. Therefore, the capacitance omission of each capacitor by the use over a long period of time is detectable by judging the voltage relation mentioned above.

[0031]But required circuitry becomes complicated and judging a relation with the levels E3 and E2 of each capacitor does not necessarily have it. [practical] Drawing 5 explains the method which can detect the capacitance omission of a capacitor with comparatively simple composition. Namely, that the voltage E3 when the regulation capacitor 9 is connected in parallel with the capacitor 5 is higher than the voltage E2 of other independent capacitors 6, Since the sum of the electric capacity of the capacitor 5 and the regulation capacitor 9 means being smaller than the electric capacity of the independent capacitor 6, While having repeated charge and discharge, even if the rated voltage E1 is reached and it connects a regulation capacitor, What is necessary is to become what the upper limit voltage Em set up highly is exceeded for (drawing 5 time t4), to detect this phenomenon, and just to judge with a capacitance omission (capacity deterioration) only, from the rated voltage E1, before the voltage of other capacitors connected in series reaches the rated voltage E1. Therefore, the capacity deterioration of a capacitor can be judged certainly simple only by adding a means to detect that the voltage of the capacitor exceeded the upper limit voltage Em in the voltage detection circuits 15, and what is necessary is just to process the display of an alarm, etc. with this output. It cannot be overemphasized that detection of the capacity deterioration of the

capacitor by this method is applicable to other embodiments as it is.

[0032]Embodiment 3. drawing 6 is a circuitry figure showing the capacitor accumulating electricity device in this embodiment of the invention 3. The voltage detection circuits 17 make the thyristor element 18 (Th) one here, when the voltage of the capacitor 5 exceeds the rated voltage E1. The regulation capacitor 9 is connected in parallel with the capacitor 5 by this, and the voltage falls to E3 similarly with drawing 4 having shown by it (time t2). Then, in time t3, go up gently, and other capacitors 6 reach the rated voltage E1, and here, If the closed circuit of open and the switch 4 is carried out and it goes into discharge mode, the electric charge of the regulation capacitor 9 will discharge the switch 3 with the capacitor 5, but at this time, the diode 13 flows and the thyristor element 18 is automatically turned off according to this. If it goes into charging operation again, an OFF state will be maintained and the regulation capacitor 9 will not be connected until one [the thyristor element / the voltage detection circuits 17 / the thyristor element 18 detects the rated voltage E1 and / with the output]. Therefore, in Embodiment 2 of a relay type, the hysteresis characteristic of the voltage E4 of required voltage detection circuits becomes unnecessary.

[0033]Embodiment 4. drawing 7 is a circuitry figure showing the capacitor accumulating electricity device in this embodiment of the invention 4. Here, if the voltage of the capacitor 5 exceeds the rated voltage E1, the voltage detection circuits 19 will output a driving signal to the base of the transistor 20, and they will connect the regulation capacitor 9 in parallel with the capacitor 5. [the voltage detection circuits] [the transistor 20] After that, a direct current between the collector emitters of the transistor 20 is controlled in analog, and the voltage of the capacitor 5 is maintained at rated voltage E1 regularity. That is, the same characteristic is obtained with drawing 2 having explained by the continuous control of an analog, without being accompanied by the switching operation of turning on and off.

[0034]Embodiment 5. drawing 8 is a circuitry figure showing the capacitor accumulating electricity device in this embodiment of the invention 5. They are load, a switch (SW1, SW2) with which 21 performs a constant current source, 22 performs 23, and 24 perform the constant current source 21 and ON OFF of the load 22 in a figure, respectively, and the capacitor (nominal capacity Ca) which made 25 in-series mutually and was connected to the constant current source 21, Here, the case where the three capacitors 25 are connected in series is illustrated. 26 is provided every capacitor 25, it is the 1st voltage detector as the 1st voltage detection means that detects the voltage between the terminal and operates, and the details are mentioned later. As for 27, a thyristor element and 29 are diodes a regulation capacitor (nominal capacity Cb) and 28.

[0035]30 is provided every capacitor 25, it is the 2nd voltage detector as the 2nd voltage detection means that detects the voltage between the terminal and operates, and the details are mentioned later. The relay whose 31 is an operation output of the 2nd voltage detector 30,

and 32 are action indication lights which operate at the point of contact of the relay 31. 33 and 34 are the overvoltage detection machines as a charge circuit opening means and relays which separate the constant current source 21 and capacitor 25 group, when the voltage of the series connection body of the capacitor 25 is detected and this detection voltage exceeds predetermined upper limit.

[0036]Drawing 9 is a circuit diagram showing the detailed composition of the 1st voltage detector 26 of drawing 8. The voltage of the capacitor 25 by which the partial pressure was carried out with the voltage divider which IC1 is system-reset IC and consists of the resistance R1 and R2 in a figure is inputted, If this input voltage reaches the 1st predetermined specified voltage (voltage equivalent to the rated voltage E1 explained by the previous embodiment), that output will change from H" level to ""L" level. By the level variation of this output, the transistor TR of an output side turns off, and ignition signals are sent out to the thyristor element 28. [LED (light emitting diode)] And since the regulation capacitor 27 of the operation by which a connection injection is carried out in parallel with the capacitor 25 is the same as that of the case of previous Embodiment 3 (drawing 6), explanation is omitted. [the thyristor element 28]

[0037]The 1st specified voltage that is the detecting operation voltage of IC1 is performed by adjusting the ratio of resistance R1 and R2. LED of the output side of IC1 serves as a displaying means which tells outside that the regulation capacitor 27 of the in-series stage concerned was thrown in by the emission operating. This LED has the work which that diode drops voltage prevents invasion of the gate noise to the thyristor element 28, etc., and prevents this that operation at the time of usual (at the time of OFF).

[0038]Drawing 10 is a circuit diagram showing the detailed composition of the 2nd voltage detector 30 of drawing 8. The voltage of the capacitor 25 by which the partial pressure was carried out with the voltage divider which IC2 is system-reset IC and consists of the resistance R1 and R2 in a figure is inputted, If this input voltage reaches the 2nd predetermined specified voltage (here, set as the same value as the 1st specified voltage), that output will change from H" level to ""L" level. However, when the capacitor Cd for delay is connected to this IC2, input voltage reaches the 2nd specified voltage of the above and that state continues to a predetermined time delay (it is set as about 0.3 to 1.0 sec), it has the composition that an output level changes.

[0039]The output change of IC2 is transmitted in the form electrically insulated with the circuit of the capacitor 25, and makes the thyristor element 35 of a display circuit the one by passing the photocoupler Hc. While the light emitting diode 36 lights up and displaying operation of the 2nd voltage detector 30 on the exterior by this, the display action is held by work of the thyristor element 35. Maintenance of the above-mentioned display action can be canceled by pushing the reset switch 37 and opening this display circuit.

[0040]Although that display output circuit is what turns on the action indication light 32 with the relay 31, of course, it is good also as a display circuit of this method in the 2nd voltage detector 30 shown in drawing 8.

[0041]Next, drawing 11 explains the operation which detects the capacity deterioration of the capacitor 25 by the 2nd voltage detector 30. Drawing 11 serves as contents substantially equivalent to drawing 5 explained by previous Embodiment 2. In drawing 11, if charge is started in time t1, the voltage between the terminal will rise by a steep slope from other capacitors (P1), and the capacitor 25 which has produced capacity deterioration will reach the 1st specified voltage E1 (= the 2nd specified voltage) in time t2.

[0042]Thereby, the 1st voltage detector 26 operates promptly, the regulation capacitor 27 is thrown in, and the voltage of the capacitor 25 plunges to E2. [the voltage detector] [the thyristor element 28 of the output side] Since the 2nd voltage detector 30 has the delay element mentioned already, charging operation will continue without performing output operation by the sudden drop of the above-mentioned voltage.

[0043]For the capacity deterioration of the capacitor 25 concerned, even the voltage between the terminal of after regulation capacitor 27 injection is higher than the voltage of other capacitors, and the 2nd specified voltage (E1) is reached in time t3. Since the regulation capacitor 27 is already injection settled, if it continues till the time t4 (=t3+deltat) when the voltage between terminals of the capacitor 25 concerned continued the rise at, and time deltat of the delay element of the 2nd voltage detector 30 has passed since the time t3, The 2nd voltage detector 30 performs output operation, and the light emitting diode 36 performs a display action (refer to drawing 10). [the voltage detector] [the thyristor element 35] Therefore, in this time t4, the voltage between terminals of the capacitor 25 serves as E1+deltaE=Em by time deltat progress power-surge part deltaE Added from the 2nd specified voltage (E1). That is, the capacity deterioration detecting operation characteristic equivalent to drawing 5 having explained is obtained as pointed out previously.

[0044]Although the detecting operation of the 2nd voltage detector 30 shall perform a display output, it may be made to open a charge circuit by making the switch 23 (SW1) of drawing 8 open in drawing 8 and drawing 10, for example in addition to this display output. Opening of a charge circuit is good also as a method which detects this with the overvoltage detection machine 33, operates the relay 34, and opens the point of contact, when the voltage of the whole capacitor series body exceeds predetermined upper limit. Opening of a charge circuit is good also as a method which opens the switch 23 (SW1), when a detecting signal is outputted from all the 1st voltage detector 26 (i.e., when the regulation capacitor 27 of all the stages is thrown in). The all directions type mentioned above is used together, and it may be made to open a charge circuit.

[0045]In explanation of drawing 8 - drawing 10, although it is mutually considered as the thing

of individual and independent composition, respectively, the 1st voltage detector 26 and 2nd voltage detector 30 are made with the composition which shares the voltage divider which consists of the resistance R1 and R2, when making both specified voltage of operation the same. Since the structure of an adjusting part becomes easy as for this and both specified voltage becomes certainly the same, there is an advantage that both discrimination can be performed only by setting out of the delay element of the 2nd voltage detector 30. Of course, if both are considered as independent composition, it is possible to set specified voltage as a mutually different value.

[0046]embodiment 6. -- here, the optimal example of composition at the time of using an electric double layer capacitor for each capacitor is explained. When the capacitor accumulating electricity device which connects now, for example, nine capacitors, to 3 series and 3 parallel is assumed, the method shown in drawing 12 (a) and (b) as connection types, such as a regulation capacitor explained above, a switching means, and a voltage detector, can be considered. However, in drawing 12, these regulation capacitors are displayed with one block for simplification of a graphic display. Drawing 12 (a) connects what connects a regulation capacitor etc. for every one capacitor, and the figure (b) for every in-series stage of the capacitor which carried out multiple connection.

[0047]As compared with the method of (a), the method of (b) it not only can reduce the number, such as a regulation capacitor, but, Previously, the capacity deviation of the capacitor explained by (1) - (3) type so that the deviation of the synthetic capacity during management, i.e., the capacitor group connected in parallel mutually, may become smaller than the capacity deviation of capacitor each, The required capacity of a regulation capacitor can be reduced by considering the capacity deviation of each capacitor and distributing the connecting location.

[0048]And when application to an electric double layer capacitor was considered, the very convenient thing became clear apart from the advantage which the method of the above (b) mentioned above. That is, in the internal structure, the electric double layer capacitor needs to apply a pressure to those contact surfaces, in order to maintain at a small value the electrical resistance between the electrode sheets which consist of an aluminum electrode and an active carbon sheet, the contact resistance between activated carbon particles, etc. In this case, although the capacitor of cylindrical shape can apply tension at the time of that winding and can make a pressure hold, it is necessary to pressurize it via a spring etc. from the exterior by the lamination type capacitor of rectangular parallelepiped shape.

[0049]Drawing 13 shows the example of composition of the electric double layer capacitor at the time of adopting the method of drawing 12 (b). Namely, as shown in drawing 13, C21, a part for the 1 in-series stage C11, for example, the capacitor, of drawing 12 (b), C31, and a total of four capacitors of the regulation capacitor of this stage, It accommodates in the frame of an approximately U shape, and is considered as one module, by this module unit, as shown

in a graphic display arrow, external force is applied, and a pressure common to each capacitor is supplied. Since the connection in each capacitor is also multiple connection, it becomes structure is [that what is necessary is just to arrange the busbar of a couple in parallel] very easy, and easy [manufacture]. What is necessary is just to maintain exchange, restoration, etc. by this module unit, when capacity deterioration is actually detected since the capacity deterioration of a capacitor is detected by the module unit. If the capacity of the regulation capacitor is set up more greatly than the capacity of the capacitor C11 grade connected to this, Even if either of the capacitors in which multiple connection is carried out by the long term deterioration by years of use breaks down and capacity decreases, operation is normally continuable as a capacitor accumulating electricity device by connecting a regulation capacitor and utilizing the capacity for the margin. When degradation of the capacity which exceeds the capacity of a regulation capacitor arises, the degradation detection function by the 2nd voltage detector will act.

[0050]Since the capacitor C11 by which the series connection was carried out, for example, a capacitor, C12, and C13 will be constituted as one module in the case of the method of drawing 12 (a), the module unit which contains other normal capacitors also when the capacity deterioration of one capacitor is detected, while the connection configuration between each capacitor becomes complicated -- maintenance -- not carrying out -- it does not obtain but the meaning which performs complicated and detailed degradation detection for every capacitor simple substance is reduced.

[0051]

[Effect of the Invention]As mentioned above, the capacitor accumulating electricity device concerning this invention, In the capacitor accumulating electricity device which connects two or more capacitors in series, connects a constant current source to this series connection body, and charges the above-mentioned capacitor, The 1st voltage detection means that will output a detecting signal if it is provided for every above-mentioned capacitor, the voltage between that terminal is detected and this detection voltage reaches the 1st predetermined specified voltage, The series connection body of the regulation capacitor and switching means which were connected between the terminals for every above-mentioned capacitor, And it has the 2nd voltage detection means that will output a detecting signal if it is provided for every above-mentioned capacitor, the voltage between that terminal is detected and this detection voltage reaches the 2nd predetermined specified voltage, If a detecting signal is outputted from the 1st voltage detection means of the above, when the 1st voltage detection means concerned will carry out the closed circuit of the connected switching means at the time of charging operation, While enabling equalization of the amount of the maximum charging charge of each capacitor group by which the series connection was carried out [above-mentioned], Without using the partial pressure resistance which generates power loss by the

injection of a regulation capacitor based on the 1st voltage detection means, since it was made to judge with the capacitor to which the 2nd voltage detection means concerned was connected carrying out capacity deterioration when the detecting signal was outputted from the 2nd voltage detection means of the above, While being able to charge the capacitor of each stage at specified voltage regularity and being able to provide a capacitor accumulating electricity device with high utilized capacity by low-loss, the capacity deterioration of each capacitor is detectable by the 2nd voltage detection means.

[0052]The capacitor accumulating electricity device concerning this invention, Since the 1st and 2nd specified voltage was made into the same value and the output responses of the detecting signal of the 2nd voltage detection means were made later than the output responses of the detecting signal of the 1st voltage detection means, The positive capacity deterioration detecting operation characteristic that no malfunction is is obtained by easy setting out which provides a difference in the output responses of the 1st and 2nd voltage detection means.

[0053]Since the capacitor accumulating electricity device concerning this invention shall detect the voltage between terminals of that capacitor via a voltage divider and the 1st and 2nd voltage detection means shared the above-mentioned voltage divider, the composition of a voltage detection means becomes easy.

[0054]The capacitor accumulating electricity device concerning this invention, Since it had the capacitor degradation displaying means which displays the capacitor judged with the detecting signal from the 2nd voltage detection means to be capacity deterioration as other capacitors identifiable, the capacitor which capacity deterioration generated can be certainly distinguished out of two or more capacitors.

[0055]The capacitor accumulating electricity device concerning this invention, Since it had the charge circuit opening means which separates a constant current source and a capacitor group when a detecting signal was outputted from all that 1st voltage detection means, the overvoltage application which may be produced after throwing in all the regulation capacitors is prevented, and the safety reliability as a capacitor accumulating electricity device increases.

[0056]Since the capacitor accumulating electricity device concerning this invention was provided with the charge circuit opening means which separates a constant current source and a capacitor group with the detecting signal from that 2nd voltage detection means, the overvoltage application to the capacitor which capacity deterioration produced is prevented, and the safety reliability as a capacitor accumulating electricity device increases.

[0057]The capacitor accumulating electricity device concerning this invention, Since it had the charge circuit opening means which separates a constant current source and a capacitor group when the voltage of the series connection body of that capacitor was detected and this detection voltage exceeded predetermined upper limit, Regardless of the state of each

capacitor, the overvoltage application as the whole capacitor accumulating electricity device is prevented, and the safety reliability is secured.

[Translation done.]